15

CLAIMS

1.   A flow sensor, in particular suitable for use in air flow measuring, comprising an impeller which is suspended for free rotation in a tube section and which comprises a central core and a number of blades extending from the core, wherein at least one blade extends from the core to adjacent the inner wall of the tube section, wherein measuring means are included for measuring the number of revolutions of the impeller per unit of time, wherein the flow sensor is adapted to register, when a calibration flow rate is passed through the tube, an associated calibration speed of the impeller by means of the measuring means, wherein to at least a series of cross sections of the blade it applies that the blade angle substantially meets the formula

$$[tg(H(r)) * Caldeb * C]/[r * D^2] = Calrev$$

wherein

      r   = distance section relative to the center of the core (m);

      $H(r)$ = blade angle of section at distance r (°);

      Caldeb = calibration flow rate (m^3/h)

      Calrev = calibration speed (rev/min)

      D   = diameter tube section (m)

wherein $0.003 < C < 0.004$ and C is preferably $6.67/1974$.

2.   A flow sensor according to claim 1, characterized in that to each cross section of the blade it applies that the blade angle substantially meets the formulae

$$[tg(H(r)_{max}) * Maxdeb * C]/[r * D^2] < Maxrev$$

and

$$[tg(H(r)_{min}) * Mindeb * C]/[r * D^2] < Minrev$$

wherein:

      $H(r)_{max}$ = maximum blade angle section at distance r (°);

      $H(r)_{min}$ = minimum blade angle section at distance r (°);

      Maxdeb = maximum measuring flow rate (m^3/h)

      Mindeb = minimum measuring flow rate (m^3/h)

      Maxrev = maximum measuring speed (rev/min)

      Minrev = minimum measuring speed (rev/min)

16

3. A flow sensor according to claim 1 ~~or 2~~, characterized in that to substantially each combination of two cross sections of the blade it applies that

$$[r_1*\cos(H_1)*B_1]/[r_2*\cos(H_2)*B_2]>1$$

5   wherein:

   r_1 = distance first section relative to the center of the core (m);

   r_2 = distance second section relative to the center of the core (m);

10   wherein $r_2 > r_1$;

   H_1 = blade angle first section (°);

   H_2 = blade angle second section (°);

   B_1 = Blade width first section (m); and

   B_2 = Blade width second section (m),

15   wherein to all blade angles of the impeller it applies that they lie in one quadrant and that the blade angle (H) and blade width (B) have a flowing curve over the blade.

4. A flow sensor according to _Claim 1_ ~~any one of the preceding claims~~, characterized in that the impeller comprises two

20   blades which together with the core cover the entire diameter of the relevant cross section of the tube section, the blades preferably being arranged diametrically opposite each other.

5. A flow sensor according to _Claim 1_ ~~any one of the preceding claims~~, characterized in that the distance between the free

25   end of ~~the or~~ each blade and the inner wall of the tube section is less than 2%, and preferably approximately 1% of the diameter of the tube section.

6. A flow sensor according to _Claim 1_ ~~any one of the preceding claims~~, characterized in that for each blade the blade curve

30   at the leading side is less than 5°, and preferably approximately 0°.

7. A flow sensor according to _Claim 1_ ~~any one of the preceding claims~~, characterized in that to a cross section of each blade it applies that the cross section has the greatest thickness

35   at a distance of about 1/3 of the blade width, measured from the front edge of the blade, the greatest blade thickness being preferably about 10% of the relevant blade width.

8.   A flow sensor according to ~~any one of the preceding claims~~, characterized in that the core has a frontal surface of no more than approximately 10% of the internal cross section of the tube section.

9.   A flow sensor according to ~~any one of claims 1-8~~, characterized in that in the tube section, downstream of the impeller, a ventilating fan is arranged for drawing in air, via the tube section, from the side of the impeller remote from the ventilating fan and through the plane covered by the impeller during a revolution, and for delivering said air outside the tube section.

10.   A flow sensor according to claim 9, characterized in that during use, the ventilating fan rotates in a direction opposite to that of the impeller.

11.   A flow sensor according to claim 9 ~~or 10~~, characterized in that the distance between the blades of the ventilating fan and the blades of the impeller at least corresponds to the diameter of the tube section.

12.   A flow sensor according to ~~any one of claims 9-11~~, characterized in that on the side of the impeller, the tube section comprises an outwardly bent inflow edge whose curvature radius is greater than 10% of the diameter of the tube section, the impeller being disposed at the level of the inflow edge.

13.   A flow sensor according to ~~any one of claims 9-11~~, characterized in that on the side of the impeller, the tube section comprises an outwardly bent inflow edge whose curvature radius is greater than 10% of the diameter of the tube section, the impeller being disposed at a distance from the inflow edge which is at least half the diameter of the tube section.

14.   A ventilating device, in particular suitable for use for the ventilation of spaces, wherein a flow sensor according to ~~any one of the preceding claims~~ is included ~~in one of the boundaries of a space to be ventilated~~, wherein switching means are included for regulating, on the basis of the speeds of the impeller registered by the measuring means and an air

composition measured within the space, the amount of air to be discharged from the space by the flow sensor.

15. An impeller for arrangement in a tube section, comprising a central core and a number of blades extending from the core, characterized in that to substantially each combination of two cross sections of the blade it applies that the blade angles meet the equation

$$(r_2/r_1) * \tan(H_1) = \tan(H_2)$$

wherein

r_1 = distance first section relative to the center of the core (m);

r_2 = distance second section relative to the center of the core (m);

H_1 = blade angle first section (°);

H_2 = blade angle second section (°).

16. An impeller according to claim 15, characterized in that there is a calibration combination of a calibration flow rate and a calibration speed wherein to substantially each cross section of the blade it applies that the blade angle meets the formula

$$[tg(H(r)) * Caldeb * C]/[r * D^2] = Calrev$$

wherein

r = distance section relative to the center of the core (m);

H(r) = blade angle at distance r (°);

Caldeb = calibration flow rate (m³/h)

Calrev = calibration speed (rev/min)

D = diameter intended tube section (m)

wherein $0.003 < C < 0.004$ and C is preferably $6.67/1974$.

17. A method of using the a flow sensor, comprising an impeller disposed in a tube section, said impeller having at least a core, a number of blades extending from the core, core bearing means, means for securing the core bearing means in a tube section and impeller rotation-measuring means, wherein, on the basis of the use of the flow sensor and the measuring range of the measuring means, a suitable tube section diameter and a suitable combination of a

calibration flow rate and an associated calibration speed are selected, whereupon the blade angle of each cross section of the blade is determined, said blade angle meeting the equation

$$[tg(H(r)) * Caldeb * C]/[r * D^2] = Calrev$$

wherein

r = distance section relative to the center of the core (m);

H(r) = blade angle of section at distance r (°);

Caldeb = calibration flow rate (m^3/h)

Calrev = calibration speed (rev/min)

D = diameter tube section (m)

wherein $0.003 < C < 0.004$ and C is preferably 6.67/1974.

18. A method according to claim 17, characterized in that a maximum and minimum flow rate to be measured during use and a maximum and minimum impeller speed desired therefor are determined, whilst for each cross section a blade angle is selected to which it applies that it lies between two limit values $H(r)_{max}$ and $H(r)_{min}$ meeting the following formulae

$$[tg(H(r)_{max}) * Maxdeb * C]/[r * D^2] < Maxrev$$

and

$$[tg(H(r)_{min}) * Mindeb * C]/[r * D^2] < Minrev$$

wherein:

r = distance section relative to the center of the core (m);

$H(r)_{max}$ = maximum blade angle section at distance r (°);

$H(r)_{min}$ = minimum blade angle section at distance r (°);

Maxdeb = maximum flow rate (m^3/h)

Mindeb = minimum flow rate (m^3/h)

Maxrev = maximum speed (rev/min)

Minrev = minimum speed (rev/min)

wherein $0.003 < C < 0.004$ and C is preferably 6.67/1974.

19. A method according to claim 17 or 18, characterized in that for each cross section of each blade, a width and blade angle are determined so that to substantially each combination of two cross sections of the blade, it applies that

$$[r_1*cos(H_1)*B_1]/[r_2*cos(H_2)*B_2] > 1$$

wherein:

r_1 = distance first section relative to the center of the core (m);

r_2 = distance second section relative to the center of the core (m);

5   wherein $r_2 > r_1$;

H_1 = blade angle first section (°);

H_2 = blade angle second section (°);

B_1 = Blade width first section (m); and

B_2 = Blade width second section (m),

10   and so that to all blade angles of the impeller it applies that they lie in one quadrant and that the blade angle (H) and blade width (B) have a flowing curve over the blade.